being prepared at Vienna to start next summer. One half of the expedition will seek to advance to the north, under Lieut. Payer, by way of East Greenland, and the other half, under Count Wilczek, will proceed *viâ* Siberia. The object of the expedition is to ascertain if the newly-discovered Franz-Joseph Land is a continent or an island.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE twenty-third meeting of this Association, which commenced at Hartford, under the presidency of Dr. J. L. Le Conte, on Aug. 12, seems to have been a successful one. Apart from the regular growth in prosperity which is exhibited every year, there was the unusual accession of the chemists, who have resolved to make their science strongly represented, and there was the excitement and interest which attended an important change in the constitution of the Association. The nature of the change we have already indicated (vol. x. p. 382). There was an unusually large attendance of the most eminent American representatives of science. The Association meets at Detroit next year on the second Wednesday of August.

The president's address consisted chiefly of allusions to some of the principal scientific events of the year, and of a summary of the matters to come before the Association. At a later period of the meeting the retiring president gave his address, in which he reviewed the progress of scientific instruments and methods. We can only refer very briefly to some of the more important papers read.

In a paper *On the Periodicity of the Rainfall in the United States in Relation to the Periodicity of the Solar Spots*, by Prof. John Brocklesby, the author concludes from his investigations that in the United States there is a connection existing between rainfalls and variations in the sun-spot area; the rainfall rising above the mean when the sun-spot area is in excess and falling below it when it is deficient.

Differential Measurements of Solar Temperature, by Prof. S. P. Langley of Pittsburgh, Pa. After stating the aims of the Alleghany Observatory at Pittsburgh, and giving details of the work now carried on there, consisting largely of observations and photographs of the sun, Prof. Langley said that there is a very wide variation in both the heat and light, and probably also in the actinic force of different parts of the sun. The difference is due principally, but not wholly, to differences in atmospheric absorption. Prof. Henry observed that the image of a sun-spot is colder than the photosphere surrounding it. Secchi has shown that the heat of the sun diminishes as we approach its edge, and he thinks that there is a different temperature at the sun's equator and the poles. Prof. Langley gave details of his own experiments with a thermopile upon these points. He finds that the observation of Prof. Henry is correct. But comparing the image of the spot with the photosphere immediately surrounding it, he finds that the image of a spot not far from the centre is uniformly warmer than that of the edge. To get the full significance of this observation we must consider that the image of the same spot is at the same time darker and colder than the photosphere near the centre, and darker and warmer than the photosphere near the edge. A series of measurements of the heat from the centre to the edge were made.

It does not appear as the result of these experiments that there is so great a selective absorption of heat in the lower regions of the sun's atmosphere, that when rays come from the edge of the disc and pass through a greater proportional thickness of his atmosphere, the heat is filtered from them and the light allowed to go through. We find that the heat falls away so very rapidly towards the edge as to indicate a much greater thinness of the solar chromosphere than has been hitherto admitted. We appear to have been led to the conclusion that there is a local obscuration over the spot very remarkable both in degree and kind. Prof. Langley exhibited a photograph of a sun-spot that looked, he said, like a sketch of a crystallising substance; when, however, we consider the enormous areas involved, we find the analogies of crystallisation wholly fail us, and we may more probably account for the facts by a hypothesis of cyclonic action. He concluded by pointing out the great value of these studies in connection with investigations in terrestrial meteorology.

Distribution of the Poles of Nebulæ, by Prof. Cleveland Abbe, of Washington. The general problem attacked in the present paper is the question whether there are planes that have a definite relation to nebulæ.

It may in general be stated that the positions of planes of rotation among the nebulæ do not show any such uniformity as is the case with the solar system: on the contrary, they are at all possible angles with each other. But there is this remarkable feature: that their nodes cluster about a point in R.A. 12h. 45m. and declination 60° N., that point being the North Pole of the plane near which lie the majority of the so-called axes of rotation.

Cave Fauna of the Middle States, by Prof. A. S. Packard, jun., of Salem, Mass.—For about a month during the last part of April and early in May last, Prof. Packard was engaged with Mr. T. G. Sanborn in exploring the caves of Kentucky under the auspices of the Geological Survey of that State, Prof. Shaler accompanying Prof. Packard. They first examined the Mammoth Cave, and doubled the number of animals known to exist therein and in others adjoining. An exploration, with Prof. Shaler, of the Carter Caves in Grayson County, Ky., also revealed a rich fauna composed of twenty species. Prof. Packard also examined Wyandotte Cave alone, and found a wingless Procus and two species of Thysanura new to the cave. Several caves within sixteen miles of New Albany, Ind., at Bradford, were examined. Finally, a careful examination of Weyer's Cave, in Virginia, and the adjoining Cave of the Fountains revealed a fauna containing some twenty species, no life having been previously reported from those caves.

These results show a great uniformity in the distribution of life—more than would at first be expected, though these caves lie in a faunal region nearly identical as regards the external world, and the temperature of the caves is very constant. Still some notable differences occurred.

Change by Gradual Modification not the Universal Law, by Thomas Meehan, of Germantown, Penn.—After adducing many instances in support of the theory that new forms are often generated by "leaps," Mr. Meehan concludes with the following propositions:—1. Morphological changes in individual plants are not always by gradual modifications. 2. Variations from specific forms follow the same law. 3. Variations are often sudden and also of such decided character as to seem generic. 4. These sudden formations perpetuate themselves similarly in all respects to forms springing from gradual modifications. 5. Variations of similar character occur in widely separated localities. 6. Variations occur in communities of plants simultaneously by causes affecting nutrition, and perhaps by other causes. Mr. Meehan argues from these premises that new and widely distinct species may be suddenly evolved from pre-existing forms without the intervention of connecting links.

This paper provoked considerable discussion. Prof. Morse said that the impression seemed to prevail among a great many that Prof. Meehan's paper was an argument against Darwinism, while in reality, in whatever sense you look at it, it was a corroboration of the theory of evolution. Prof. C. V. Riley insisted that most of the circumstances cited by Prof. Meehan found their parallels in what were generally known to zoologists as well as botanists as "sports" or even "monstrosities," and that Mr. Darwin himself had instanced some of the most interesting cases.

Prof. Asa Gray remarked that he only wished to state in respect to variations occurring abruptly as they did, that those certainly were not the kind of things which Mr. Darwin would have regarded as in any way interfering with his view, and he did not think Mr. Meehan had rightly comprehended the statement to which he had called attention. "I think (pursued Prof. Gray) that the statement, whatever it is, taken in connection with the remark which Mr. Riley made, and which Mr. Darwin a good deal insists upon, viz., that he does not look to monstrosities for the introduction of new forms, because the monstrosities may be expected to be taken out of relation to the surrounding circumstances, and that it is only those modifications which are in relation to surrounding and changing circumstances that can be utilised and turned to account—is not to be found fault with. Mr. Darwin distinctly notes that monstrosities may be hereditary, and so may be supposed even to be continued if they were sufficient in relation to surrounding circumstances. So, if Mr. Darwin readily takes into his view changes like that which everyone calls monstrosities, he may readily be expected not to regard it as any infringement upon the maxim that varieties should come into existence quite abruptly with considerable differences. I think it is true that varieties are apt to arise in that way with very considerable differences, and so true that those surely are not the kind of things to which Mr. Darwin looks as difficulties to overcome, but as stepping-stones in his way."

Glacial Phenomena in the Sierra Nevada, by Prof. John Muir, of Oakland, Cal.—The studies of Prof. Muir referred particularly to that portion of the Sierra which is embraced between lat. 36° 30′ and 39°, which measures about 200 miles in length by about 60 in width, and attains an elevation along the axis from 8,600 ft. to nearly 15,000 ft. above the sea. All the individual mountains distributed over this vast area, of whatever kind, have been brought into relief during the glacial epoch by the direct mechanical action of the ice-sheet and the glaciers into which it afterwards separated. The chief phenomena presented are:—(1) scratched and polished surfaces, (2) moraines, (3) moutonned rock-forms, and sculpture in general, as seen in valleys, ridges, lake basins, and separate mountains.

The paper goes on to describe the lofty mountains distributed along the summit of the portion of the Sierra under consideration, which are almost wholly unexplored—Mounts Dana, Lyell, Whitney, and Tyndall. The Pinnacles, which are the smallest of the summit mountainets, are described in an interesting way, the author concluding that instead of each being formed by special upheaval, or supposing that the chasms which separate them were made by subsidence, they were formed by the removal of the materials which once filled the intervening chasms. The same truth applies to the larger peaks, and the author concludes this branch of his subject by saying that they are all residual masses of the once solid wave of the entire range, and all that would be required to obliterate their distinctive character would be the restoration of the materials which have been carried away.

The next inquiry is, what has become of this material, not the millionth part of which can now be seen? and the author answers himself with the statement that glaciers were the transporting agents, and that in forming the basins and valleys in which they flowed, they carved out the summit peaks. This is so important a proposition as to demand careful attention to its proof. This proof is brought forward in detail. Subsequently, granting this proposition to be true from the proof, the author is obliged to go on to show what force or forces have sharpened the crests, which bear no trace of glacial action, and which were probably always above its reach. Next is considered the formation of special groups of mountains, and the geological effects of shadows—in prolonging and intensifying the actions of portions of glaciers, as shown in moraines, lake basins, and in the difference in form and sculpture between the north and south sides of valleys and mountains; especially as to their effects in the segregation of mountain masses. Also as to the effect of physical structure upon surface features, and the cause of the absence of well-marked individuality in summit mountains.

Prof. F. W. Clarke, of the University of Cincinnati, read a paper *On the Molecular Volume of Water of Crystallisation.* He stated that, to the chemist, it is important to get at some distinguishing character between water of crystallisation and true water of hydration. This character may be found by a study of the molecular volumes of various hydrated compounds. If we determine the molecular volume of frozen water, that is ice, we shall find it to be 19·6. If that water unites to form a hydrate or a crystalline salt, contraction ensues, and by studying that contraction we get at curious results. In the case of water of crystallisation, Prof. Clarke has studied over thirty salts, and in every case the molecular volume of the water is about 14. With water of hydration no such regularity is found. Evidently, then, when water unites with an anhydrous salt from water of crystallisation, all the condensation which occurs is on the part of the water, the volume of the molecule of the salt itself remaining unchanged.

Prof. Clarke also read a paper *On the Molecular Heat of Similar Compounds.* Prof. Clarke said that it is commonly thought that similar compounds have equal molecular heat. This is only approximately true. In comparing about twenty series of similar compounds, Prof. Clarke finds that the molecular heat increases slightly with the molecular weight, though in a very different ratio. In comparing all the extant determinations of specific heat, he has found only two or three exceptions to this rule, and even they were doubtful.

Prof. R. E. Rogers, of the University of Pennsylvania, read a *Notice of Prof. A. K. Eaton's new Compound One-prism Spectroscope.* The instrument is the invention of a Brooklyn chemist, and is by himself named "a direct-vision spectroscope." It consists of a thick plate of glass with parallel sides, united to one of the faces of an ordinary bisulphide of carbon prism, or a prism of dense flint-glass. According to the amount of dispersion desired, the light is made to enter either on the end of the glass plate or on the opposite face of the bisulphide prism. The results obtained from this instrument are as follows:—The dispersion of this compound prism is nearly four times greater than that of the ordinary 60° prism. The mean emergent ray is practically parallel to the incident ray. It does not deflect the ray from its original path. Many Frauenhofer lines are visible by this prism with the naked eye, while with the observing telescope all the prominent lines are clearly reversed, without the use of the slit or collimator, by merely throwing a strong beam of light by means of a mirror.

Dr. J. H. Mellichamp, of Bluffton, S.C., gave an account of some recent observations at Bluffton upon the *Sarracenia variolaris*, which abounds in that locality. This species of the pitcher plant has an elongated, conical, erect leaf, with a broad lamina curved over the opening, and a wide longitudinal wing upon one side the whole length of the tube. The upper portion is veined with purple, the intervening spaces being white and diaphanous. Dr. Mellichamp establishes the following points:—The base of the tube secretes a watery fluid, which is not sweet nor odorous, but which proves quickly fatal to all insects that fall into it. The whole inner surface is covered with very minute prickles, perfectly smooth and pointed downward, which render it impossible for an insect to ascend by walking, even when the leaf is laid nearly horizontal. Within the somewhat dilated rim of the tube there is a band half an inch in width, dotted with a sweet secretion, attractive to insects, but not intoxicating. This also extends downward along the edge of the outer wing to the very ground, thus alluring many creeping insects, and especially ants, to the more dangerous feeding-ground above, where, once losing foothold, it is impossible to regain it. Even flies escape but rarely, the form of the tube and lid seeming to effectually obstruct their flight. As the result, the tube becomes filled to the depth of some inches with a mass of decaying ants, flies, hornets, and other insects. Within this there is always found a white grub feeding upon the material thus gathered, perhaps the larva of a large fly which has been observed to stand upon the edge of the tube and drop an egg within it. Soon after the full development of the leaf the upper portion becomes brown and shrivelled, which is due to still another larva, the young of a small moth, which feeds upon the substance of the leaf, leaving only the outer epidermis, and works its way from above downward till in due time it spins its cocoon, suspending it by silken threads just above the surface of the insect *débris* at the bottom. The whole forms a series of relationships and an instance of contrivance and design, the full purport of which is still by no means fully understood. Other species of the genus, as also the allied Darlingtonia of California, manifest the same purpose of insect-capture, whatever the final object may be.

As complementary to Dr. Mellichamp's paper, Prof. C. V. Riley gave an account of his investigations on the insects more particularly associated with *Sarracenia variolaris*, which we shall reprint separately in an early number.

Number and Distribution of Fixed Stars is the title of a paper read by Prof. B. A. Gould, of Cambridge, Mass. The great work of Argelander undertook no less than a complete census of all stars in the northern hemisphere to the ninth magnitude inclusive, with as many as possible of the magnitude 9½. This was successfully executed, and an association comprising the great majority of northern observatories is now employing the working list thus obtained for the construction of a catalogue to fix star-places with the utmost attainable accuracy. The magnitudes are given to the tenth of a unit, from a number of observations on each, in the published catalogue, after having been first estimated by half units.

Prof. Littrow of Vienna made a careful enumeration of stars for each magnitude, to ascertain whether an approximate uniformity in the distribution of stars was indicated. If the magnitudes depend upon distances from us, and the stars are distributed with uniformity in space, the number of stars of any given magnitude should be proportioned to the spherical area within which they are observed. The truth of the hypothesis may be inferred from the degree of accordance between the numbers of stars of given magnitudes in the catalogue, and numbers computed from the contents of imaginary spherical shells whose radii would correspond with the respective magnitudes. An approximate indication might be obtained of the relative distances of each magnitude. Notwithstanding the difficulties which are incident to this method, due to inevitable errors of observation and comparison, Littrow believed that a sufficient degree of uniformity was demonstrated to justify faith in the general theory that there is a considerable degree of uniformity in the distances of the fixed stars within his investigation, and that there is warrant for applying his formulas—the results of his research—to regions outside of his limits. Discussing the numbers in Argelander's catalogue assorted by units as far as the eighth magnitude, he obtains the fraction 0·423 for the ratio of brilliancy between stars of two successive magnitudes; assorted by half units, the fraction is (including 8½) 0·431. Each computation gives the distance of a star of the eighth magnitude as 18, that of a star of average first magnitude being taken as a unit. The discordances between the results given by the empirical values of the formula and those from the enumeration of the catalogue are large, amounting to 39 per cent. for stars of the fourth, and 44 per cent. for stars of the ninth magnitude.

The recent completion of our Argentine Uranometry determines the actual magnitudes for all stars easily visible to the naked eye throughout the heavens. Prof. Gould thinks it improbable that the error of individual magnitudes exceeds the tenth of a unit. Prof. Heis has revised and extended Argelander's work to the nearest third of a unit for all stars visible in Central Europe with the naked eye, his lowest limit being 6⅓. The Argentine work furnishes similar data with respect to the stars in the southern hemisphere. Prof. Gould has carefully studied the results of Littrow's enumeration, is convinced of the accuracy of his computations, and accepts his formula as the best obtainable. Prof. Gould has extended a similar comparison to all the stars in the heavens of the sixth magnitude, using the numbers and magnitudes furnished by the uranometries, and obtains the value of the constant as 0·482. The accordance of this with observations may be judged from the following table:—

NUMBER OF FIXED STARS.

Magnitude.	Argelander.		Uranometries.		Whole Sky.	
	Count.	Formula.	North'n.	South'n.	Observ.	Formula.
1	6	4	8	6	14	23
1½	4	4	7	4	11	16
2	22	8	25	20	45	29
2½	12	15	35	33	68	50
3	51	28	55	41	96	85
3½	60	53	103	87	190	149
4	128	99	132	108	240	257
4½	140	186	254	154	408	444
5	379	350	392	240	632	768
5½	463	658	696	563	1,259	1,329
6	1,242	1,236	1,374	1,075	2,449	2,300
6½	2,231	2,322	—	2,022	—	3,976
7	4,608	4,362	—	3,317	—	6,879
7½	6,878	8,197	—	—	—	11,900
8	14,525	15,402	—	—	—	20,582
8½	28,486	28,937	—	—	—	35.601
9	78,185	54,370	—	—	—	61,582

The columns under "Argelander" give the numbers obtained respectively by enumeration and by the formula thence deduced, from the *Durchmusterung*, and, of course, apply only to the northern hemisphere. The columns under "Uranometries" are deduced from Heis's *Atlas Cœlestis* for the northern sky and from the Argentine Uranometry for the southern. Under the "Whole Sky" the first contains the sum of northern and southern stars from the columns immediately preceding; the second the numbers computed on the hypothesis of uniform distribution in space and equal brilliancy. Comparing these numbers with those obtained from the *Durchmusterung*, the latter must of course be doubled.

The carefully determined numbers of bright stars from the Uranometry afford no greater support to the hypothesis than those obtained from the *Durchmusterung*. While a general similarity between the numbers of count and of theory is apparent, the accordance is sufficient to warrant deductions which are not essentially vague. Still the approximate accordance, as far as it goes, may furnish us with a constant magnitude ratio for crude estimates in cosmical inquiries.

If we assume, according to hypothesis, an equal number of stars in each hemisphere, there are altogether not less than 15,300 stars as bright as the seventh magnitude. But since the count indicates an excess of bright stars in the northern sky, there may be a thousand more, as given by the formula. The numbers of the *Durchmusterung* imply the existence of over 200,000 stars as bright as the ninth magnitude, though the magnitudes of faint stars in that work seem given on the average a little too bright. The average distance of ninth magnitude stars seems to exceed 25. The manifest agglomeration of faint stars in the Milky Way shows the inapplicability of the hypothesis to stars fainter than a certain magnitude. The limit of applicability is probably considerably beyond stars of the seventh magnitude or distances twelve times the average of first magnitude stars. There is no contradiction in all this to the well-known fact of accumulation of brighter stars in certain regions.

With regard to the belief that the number of stars of any given magnitude diminishes with their distance from the Milky Way, Prof. Gould says that in the clear atmosphere of Cordoba the existence of a bright stream of stars was very noticeable, including Canopus, Sirius, and Aldebaran, with the most brilliant ones in Carina, Columba, Canis Major, the Pleiades, &c., and skirting the Milky Way on its preceding side. On the opposite side of the galaxy the same was true, the bright stars fringing it in a stream that leaves it at Alpha and Beta Centauri, comprises the constellation Lupus and a great part of Scorpio, and extends onward through Ophiucus toward Lyra. Thus a great circle or zone of bright stars seems to gird the sky, intersecting with the Milky Way at the Southern Cross, but far more conspicuous on the other. The northern intersection of this zone Prof. Gould finds in Cassiopeia, which is diametrically opposite to the Southern Cross. The right ascension of the northern node is 0 h. 50 m.; the southern 12 h. 50 m.; the declination about 60°, and very near the points where the great circle of the Milky Way has its maximum declination. The inclination of this stream of stars to the Milky Way is about 25°; the Pleiades occupying a point just midway between the nodes. Prof. Gould after making this discovery found that it had been partially anticipated by Sir John Herschel, so far as the recognition of a portion of the zone was concerned. The two classes of considerations—the approximate method furnished by the hypothesis of an equable distribution of stars, and the existence of a well-marked zone of very bright stars as much inclined to the Milky Way as the equator is to the ecliptic, may assist in determining the position of our sun with reference to its own cluster, that of the cluster itself, and the scale of distances between its constituent stars.

Prof. Wright read two papers on cognate subjects, one *On the use of Natural Twin Crystals of Quartz in the construction of Polariscopes*, and *On the nature of the Zodiacal Light and the distribution of matter which occasions it.*—Prof. Wright gave reasons for doubting whether the hypothesis of bodies rotating around the sun in all directions, and within the orbit of the earth, will account for the zodiacal light. The observed form of the zodiacal light is consistent with the supposition that the reflecting bodies move in long orbits—*i.e.*, orbits of great eccentricity.

Small Brains in Tertiary Mammals.—Prof. Marsh compares the mammals of the Eocene, Miocene, and Pliocene, with the result that in the case of the animals observed, Dinoceras and Brontotherium, a very distinct and remarkable development of brain from the lower to the higher formations.

Summer Dormancy of Butterfly Larvæ, by Prof. C. V. Riley, of St. Louis.—In this paper the author, referring to Mr. S. H. Scudder's paper in the *American Naturalist* for Sept. 1873, gave the results of his observations on the larvæ of *Phyciodes nycteis*, some of which appear to remain in a dormant state through the summer and succeeding winter.

The Disintegration of Rocks, by Prof. T. Sterry Hunt, of Boston.—This subject the speaker had noticed briefly in a communication to the Association last year on the geology of the Blue Ridge. The change of the rocks in question is a chemical one, which is the most obvious in the case of crystalline rocks; the feldspar loses its alkalies and part of its silver, being changed into clay, and the hornblende its lime and magnesia, retaining its iron and peroxide. From this results a softening and decay, to greater or less depths, of the strata, so that while they still retain their arrangement, and are seen to be traversed by veins of quartz and metallic ores, the strata are often so much changed to depths of one hundred feet or more from the surface as to be readily removed by the action of the water.

Fog Signals and Transmission of Sound, by Prof. Joseph Henry, of Washington.—Prof. Henry does not exactly accept the deductions recently made by Prof. Tyndall, having himself observed a large number of similar phenomena, and attributing them to refraction, not absorption, of sound by wind and other causes. Prof. Henry found Tyndall's explanation, that a mixed atmosphere absorbed sound, inadequate to explain the facts. The practical interference, and therefore the practical absorption, must be very inconsiderable compared with the volume of sound. In the case of the syren, such is the intensity of the sound that it would cause sand to dance on a stretched membrane at a distance of one-and-a-half miles, while a 2500-pound bell would not set the same sand in motion at a distance of thirty yards.

It has been frequently observed that a distinct echo is sometimes obtained from the ocean. Prof. Tyndall thinks the reflection is from surfaces of wind. Prof. Henry thinks it is from the surface of the waves of the ocean, and that the sound is afterwards refracted by the wind.

In a paper *On the Tails of Comets*, Mr. Henry M. Parkhurst endeavours to give data for predicting the form and appearance of these appendages.

Thermo-electric Properties of Minerals, by Professors A. Schrauf and E. S. Dana.—The interesting investigations of the late Gustave Rose, an eminent mineralogist at Berlin, have, during two or three years past, excited considerable interest in this subject. He began with the fact first announced by Hankel that some crystals of pyrite and cobaltite are electrically positive and others negative, and the endeavour to explain this opposite character on the assumption that it was connected with a condition of the right and left hemihedrism characteristic of both species. This touches a fundamental point in molecular physics, and if it could be sustained, Rose's hypothesis would be very valuable.

Schrauf and Dana, however, after the examination of a large number of minerals, comprising nearly all the metallic sulphids, have come to the conclusion that the cause of the variation of electrical character in this species must be sought elsewhere. They attribute it not to an opposite molecular condition shown in the hemihedral crystals, but to a change in chemical composition. They call their attention, in the first place, to the series of Seebach, where, for example, platinum occupies a varying position according to its degree of purity; moreover, they urge that the single case observed by Stefan, where some specimens of granular galena are positive and others of crystallised galena negative, is strong evidence against the influence of hemihedrism, as nothing of the kind can be assumed here. The force of their argument lies in the fact that they have found several other well-defined cases of minerals having peculiar varieties, and that among minerals crystallising holohedrally. Chemical analyses were here desirable to show how far the material under investigation varied in composition. In the absence of these, however, the specific gravity was resorted to as an indicator of the chemical character.

This afforded decisive results of plus and minus varieties of species, showing a decided difference in density and implying a corresponding change in composition. This was true also, in a marked manner, of cobaltite, and in a somewat less degree of pyrite, showing in each case where the explanation for the electrical character was to be looked for.

Several other conclusions were deduced from the long list of observations contained in the paper, but the foregoing will be sufficient to indicate its principal points.

Distribution of American Woodlands, by Prof. Wm. H. Brewer, of New Haven.—The flora of the United States, the author said, is believed to contain over 800 woody species, and over 300 trees. Of these trees, about 250 species are somewhere tolerably abundant, about 120 species grow to a tolerably large size, 20 attain the height of 100 ft., 12 a height sometimes of over 200 ft., and a few—perhaps 5 or 6—a height of 300 ft.

Notes on Tree Growth, by Prof. Asa Gray, of Cambridge, Mass.—Whether the trunk of a tree increases in length, in the parts once formed, is still an open question in the popular mind. From careful observations made by Prof. Gray and many others, the conclusion is that the trunks of trees do not grow in length.

Natural History at Penikese, by Prof. F. W. Putnam.—In speaking of the method of teaching at Penikese School, Prof. Putnam said :—"Text-books are not allowed. Our way was to give each student a specimen of fish and ask him or her to study that fish and tell the instructor what had been observed. Thus we developed their powers of observation upon the external character of the fish. After they had studied the fishes for about two days, they were called upon to state what they had seen. Then the anatomy of the specimens was gone into, and the students were led on step by step until they had secured a very firmly founded idea of the structure of a vertebrate animal. Then we asked questions as to the character of vertebrates, and finally they began to be original investigators. We really demonstrated in a practical way the subject, which is exciting so much attention now, of co-education of the sexes. We found that the ladies of the school were as capable in every way of making careful dissections and rendering careful accounts of the work they had done as the gentlemen, and, in fact, four or five of the ladies became original investigators before any of the gentlemen. This showed conclusively that the ladies had the power of becoming original investigators in science if they only would give the application."

Organic Change produced in the Bee, by Sophie B. Herrick, of Baltimore.—This was a very interesting paper, containing the authoress's own observations and experiments on bees.

The Reversion of Thoroughbred Animals, by Prof. Wm. H. Brewer.—It is often claimed that if the care of man be withdrawn an improved breed will retrace the steps of its ancestry and revert to its original characteristics. For some years Prof. Brewer has been investigating this subject and seeking for proof of the alleged tendency to reversion. To carefully-worded inquiries in writing, following upon every report of such "reversion," Prof. Brewer has received very numerous replies, and they are unanimously in the negative. This is certainly remarkable, following upon the confident assertions that animals so frequently exhibited the alleged tendency. The inquiries were pushed in the specific localities where the reversion was said to have occurred; the questions have been put to a large number of stock-breeders, and finally have been made by means of a printed circular. But the result was always the same, except that a smile of incredulity extended over the faces of some stock-breeders when such inquiries were put to them, and they feared they were to be made the victims of a "sell." No instances of the alleged "reversion" having been authenticated in Prof. Brewer's experience, he asked the Association to aid in exposing and refuting the pernicious notion.

REPORT OF PROF. PARKER'S HUNTERIAN LECTURES "ON THE STRUCTURE AND DEVELOPMENT OF THE VERTEBRATE SKULL" [*]

VII.—*Skull of the Snake* (Coluber natrix).

AMONG the most noticeable features of the Ophidian skull may be mentioned the ivory-like texture of the bones, the immense strength and compactness of the brain-case, and the equally remarkable mobility of the facial bones, the maxillary and palatine apparatuses and the lower jaw being arranged in such a way as to allow of the greatest possible extension of the mouth during deglutition. Another important characteristic is the bony completeness of the brain-case, which is as thoroughly closed in as that of a mammal, scarcely any part of its walls being formed in the adult either by cartilage or fibrous tissue; the inter-orbital septum, also, or laterally compressed anterior moiety of the basis cranii, so characteristic of the Sauropsida, is absent, the base of the skull being flat throughout, and abruptly terminated in front. But the most interesting and at the same time most anomalous feature is the persistence of the fœtal trabeculæ, in the form of two slender cartilaginous rods (Fig. 23, Tr), lying in grooves on either side of the parasphenoid.

The hinder part of the skull is formed by a well-ossified occipital segment, the four elements of which are firmly united with one another by suture; the single convex occipital condyle is borne chiefly by the basi-occipital, the exoccipital, however, taking a considerable share in its formation. The basi-occipital is continued forward by a broad, expanded, basi-sphenoid, produced anteriorly into a slender prolongation or rostrum (Fig. 22, Pa.S), which underlies the front half of the brain-case, and answers to the parasphenoid bone.

The parietals are completely fused together in the mid-line, where they are produced in the Pythons and Boas into a strong sagittal crest for the attachment of the temporal muscles. In their hinder half they are simply roofing bones, as in Lizards and Amphibia; but in front of the auditory capsule they extend downwards (Fig. 23, Pa^1) and meet the parasphenoid, forming with it a complete cylindrical cavity. The frontals, unlike the parietals, have only a sutural union with one another; but they, too, are produced downwards (Fr$'$), and, moreover, come into contact with one another below, above the parasphenoid, so as to form

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[*] Continued from p 250.